CLAIMS

We claim:

1. A resonator adaptable for use in magnetoresonant imaging, comprising:

a first resonant coil, comprising an electrically conductive material and having at least one discontinuity therein;

a second resonant coil, comprising an electrically conductive material, having the same number of discontinuities as the first coil,

a plurality of tabs proximate the discontinuities or a plurality of tabs and islands proximate the discontinuities adapted to form an external capacitive coupling to the resonator, and

a dielectric substrate interposed between the first resonant coil and the second resonant coil;

where the discontinuities in each coil are equally spaced and where the coils are arranged so that all of the discontinuities are equally spaced.

2. A resonator adaptable for use in magnetoresonant imaging, comprising:

a dielectric substrate;

a first resonant coil disposed on a first surface of the dielectric substrate, the first resonant coil further comprising:

an electrically conductive material arranged as a conducting loop having a first discontinuity therein;

a first land or tab disposed proximate a first end of the first discontinuity; and

a second land disposed proximate a second end of the first discontinuity, where the first and second lands form a cooperative pair of lands;

a second resonant coil disposed on a second surface of the dielectric substrate opposite the first surface of the dielectric substrate, the second resonant coil comprising:

an electrically conductive material arranged as a conductive loop having a second discontinuity, where the second discontinuity is disposed substantially at a point furthest from the first discontinuity of the first resonant coil;

a first land disposed proximate a first end of the second discontinuity; and

a second land disposed proximate a second end of the second discontinuity, where the first and second lands form a second cooperative pair of lands.

3. The resonator of claim 2, wherein each land further comprises:

a contact zone, adapted to communicate an electromagnetic signal between a scanner and the resonator; and

an insulator disposed between the land and the contact zone.

4. The resonator of claim 3, wherein the contact zone comprises at least one of (i) a metal or (ii) a superconducting material.

5. The resonator of claim 3, wherein the lands are adapted to provide capacitive coupling between at least one of a scanner channel and the resonator.

6. The resonator of claim 1, wherein the coils define a predetermined shape, which is at least one of (i) a substantially parallelogram shape, (ii) a substantially circular shape, (iii) a substantially obround shape, (iv) a substantially oval shape, or (v) a substantially non-parallelogram shape.

7. A resonator adaptable for use in magnetoresonant imaging, comprising:

a dielectric substrate;

a first resonant coil disposed on a first surface of the dielectric substrate, the first resonant coil further comprising:

an electrically conductive material having first discontinuity and a second discontinuity and otherwise forming a continuous geometry defining a predetermined shape, where the second discontinuity is disposed at a position on the first resonant coil substantially maximally separated from the first discontinuity;

a first land disposed proximate a first end of the first discontinuity;

a second land disposed proximate a second end of the first discontinuity, where the first and second lands form a first pair of lands;

a third land disposed proximate a first end of the second discontinuity; and

a fourth land disposed proximate a second end of the second discontinuity, where the third and fourth lands form a second pair of lands;

a second resonant coil disposed on a second surface of the dielectric substrate opposite the first surface of the dielectric substrate, comprising

an electrically conductive material arranged in a shape substantially congruent to the shape of the first resonant coil having a first discontinuity and second discontinuity substantially maximally separated therefrom;

a first land disposed proximate a first end of the first discontinuity;

a second land disposed proximate a second end of the first discontinuity, where the first and second lands form a third pair of lands;

a third land disposed proximate a first end of the second discontinuity; and

a fourth land disposed proximate a second end of the second discontinuity, where the third and fourth lands form a fourth pair of lands.

8. The resonator of claim 7, wherein each land further comprises:

a contact zone, adapted to communicate an electromagnetic signal between scanner and the resonator; and

an insulator disposed between the land and the contact zone.

9. The resonator of claim 8, wherein the contact zone further comprises an electrically conductive material.

10. The resonator of claim 7, wherein the lands are adapted to provide capacitive coupling between at least one of (i) a source of the electromagnetic signal and the resonator or (ii) the first resonator coil and the second resonator coil.

11. The resonator of claim 7, wherein the predetermined shape is at least one of (i) a substantially parallelogram shape, (ii) a substantially circular shape, (iii) a substantially obround shape, (iv) a substantially oval shape, or (v) a substantially non-parallelogram shape.

12. A probe useful for magnetoresonant imaging, comprising:

a housing;

a resonator, disposed in the housing, the resonator adaptable for use in magnetoresonant imaging, the resonator further comprising at least one of (i) a 1 discontinuity resonator, the 1 discontinuity resonator comprising a conductive material arranged in an otherwise continuous geometry on a dielectric substrate, the otherwise continuous geometry further comprising a single discontinuity, a first land disposed proximate a first end of the discontinuity, and a second land disposed proximate a second end of the discontinuity or (ii) 2 discontinuity resonator, the 2 discontinuity resonator comprising a conductive material arranged in an otherwise continuous geometry on a dielectric substrate, the loop further comprising two discontinuities in the otherwise continuous geometry, a first land disposed proximate a first end of the first discontinuity, a second land disposed proximate a second end of the first discontinuity, a third land disposed proximate a first end of the second discontinuity, and a fourth land disposed proximate a second of the second discontinuity; and

an amplifier adapted to receive an electromagnetic signal from the resonator and communicate that signal to an external receiver, the amplifier capacitively coupled to at least one of (i) the first resonator coil or (ii) the second resonator coil.

13. The probe of claim 12, further comprising:

a source of a cryogenic fluid; and

an inlet in the housing, the inlet in fluid communication with the source of cryogenic fluid;

wherein the conductive material is at least one of (i) a metal cooled by the cryogenic fluid or (ii) a superconducting material cooled by the cryogenic fluid.

14. The probe of claim 12, wherein the probe comprises curved profile, the curved profile comprising at least one of (i) a convex shape or (ii) a concave shape.

15. The probe of claim 12, further comprising:

the resonator is an array of resonators disposed within the housing, each resonator capacitively coupled to at least one separate amplifier, each resonator further capacitively decoupled from its nearest neighboring resonators.

16. The probe of claim 15, wherein the array of resonators is a $1\times N$ or $M\times N$ array, where the resonators have between 1 and 6 discontinuities per coil.

17. The probe of claim 16, wherein each of the resonators in the $1\times N$ array has at least one discontinuity.

18. The probe of claim 15, wherein the predetermined non-chained pattern comprises an M by N array of 2 discontinuity resonators, each adjacent resonator coil on a same surface of the dielectric being electrically isolated from each of its neighboring resonator coils on the same surface of the dielectric.

19. The probe of claim 18, wherein each adjacent resonator coil on a same surface of the dielectric is electrically isolated from each of its neighboring resonator coils via four pairs of lands attached to each resonator.

20. The probe of claim 15, further comprising:

a metal block, disposed within the housing, to which a predetermined number of the array of resonators is attached.

21. The probe of claim 18, wherein the metal block comprises copper.

22. A method of using a probe useful for magnetoresonant imaging, comprising:

connecting a probe to a source of cooling, the probe comprising a housing; a resonator disposed in the housing, the resonator adaptable for use in magnetoresonant imaging, the resonator further comprising at least one of (i) a 1 discontinuity resonator comprising a conductive material arranged in an otherwise continuous geometry on a dielectric substrate, the otherwise continuous geometry further comprising a single discontinuity, a first land disposed at a first end of the discontinuity, and a second land disposed at a second end of the discontinuity or (ii) 2 discontinuity resonator comprising a conductive material arranged in an otherwise continuous geometry on a dielectric substrate, the loop further comprising two

discontinuities in the otherwise continuous geometry, a first land disposed at a first end of the first discontinuity, a second land disposed at a second end of the first discontinuity, a third land disposed at a first end of the second discontinuity, and a fourth land disposed at a second of the second discontinuity; and an amplifier adapted to receive an electromagnetic signal from the resonator and communicate that signal to an external receiver, the amplifier capacitively coupled to at least one of (i) the first resonator coil or (ii) the second resonator coil;

connecting the amplifier to a scanner;

using fluid from the source of cooling to cool the resonator inside the housing of the probe to a predetermined temperature; and

obtaining a measurement from the amplifier.

23. The method of claim 24, wherein the probe comprises a plurality of electromagnetically decoupled resonators, each operatively in communication with a separate amplifier; and

the probe is used to obtain real time partial parallel processing magnetic resonance imaging.

24. The method of claim 24, further comprising:

providing a plurality of resonators in the housing;

using the plurality of resonators to obtain simultaneous signals, each of the simultaneous signals being obtained from at least one of (i) a single resonator coil or (ii) a single pair of resonator coils; and

processing the simultaneous signals to create a unified view of a target under the probe.

25. The method of claim 24, wherein the probe comprises a plurality of electromagnetically decoupled resonators and integrated pre-amplifiers electrically connected to a scanner.